Please keep off the grass: individual norms in virtual worlds

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This paper looks at how personal conventions are unintentionally carried from the real world into virtual environments. We look at a simple example where we investigate whether avatars will follow virtual paths, or will walk on the grass. By default, people use the paths in real world parks, but we have showed that this behaviour has carried over into virtual parks. We investigated this further, postulating that the more exposure an individual had to virtual worlds the more likely they were to break with this social convention and walk on the grass. We observed the movements of agents in a virtual park on two extended occasions, one in 2010 and the other in 2012. From this we were able to see that people, in general, were still keeping to the paths except when invited to move onto the grass. We also look at the likelihood of individuals using another mode of transport, flying. Finally, we conclude that while some patterns can be seen between the 'age' of the avatar and their movements on or off the path, more investigation must be done.

Keywords: virtual worlds, social conventions, grass, norms, Second Life, avatar, behaviour

1. INTRODUCTION

Within any society a set of rules or conventions exists. These describe the way in which an individual is expected to act if they wish to become and stay part of that society. These social norms can cover all aspects of life from a shared activity in a football club to a certain style of dress being expected. The norms may not always be strictly adhered to by all, but they set a certain level of expectation on all members of the society. Virtual worlds also have their own societies and rules: whether we are considering users in a massively-multiplayer online role-playing game (MMORPG), or in a more focused virtual environment such as a shoot-em-up game such as Call of Duty 3, there are expectations on how we will react and behave. While rules about how to dress may not be as relevant, conventions such as capitalisation being the equivalent of shouting have emerged over time.

Previous studies, e.g. Schroeder (2002) and especially Yee et al. (2007), have looked at how human-human norms are reflected in virtual worlds, especially Second Life (Linden Research Inc. (2012)),

and found that social norms such as interpersonal distance and eyegaze are reproduced in the virtual world much as in the real one. Similar results were also reported by Friedman et al. (2007), who found that when they controlled avatars in the virtual world, people moved and reacted to them much as they would in the real one. In other words, people controlling their avatars tend to, for example, keep the same distance apart and glance at their conversational partner much as they would do in real life. Yee et al. (2007) conclude:

> "our findings support our hypothesis that our social interactions in online virtual environments, such as Second Life, are governed by the same social norms as social interactions in the physical world"

but they do not consider why this may be the case. One plausible reason is that, even in a virtual world, a conversation is an innately human construct and hence we would expect human norms to naturally flow into instantiations of that. We are therefore interested in understanding what other forms of norms are obeyed in the virtual world, and what are not.

Specifically, we became interested in how people moved around in virtual worlds. We are particularly interested in individual, personal interactions with the environment, because these may demonstrate

Figure 1: *Real world social norm, made explicit*

a different normative effect. The effect we became interested in investigating was, to put it simply, "Please keep off the grass".

This instruction is often explicit, as in the sign in Figure 1, but is also an implicitly understood phenomena in the real world — by default, people wander around parks and spaces by following existing paths, sometimes venturing onto the grass for a picnic, to sit in the shade, or otherwise enjoy it, but their default movements tend to be along paths. In the real world people may chose not to step on the grass because a sign dictates it, or because of costs such as wet and muddy shoes, or because of implied social pressures to follow the default behaviours and hence use the paths, and to preserve the more fragile grass environment for the shared enjoyment of others. In this situation, the choice is a much more personal one than a conversation. Clearly, people can wander through grassy areas in pairs or larger groups, but they do not need to be so close to them as in a conversation; often, they may be exploring by themselves. We wondered whether, in a virtual world, the real world norm would also apply.

This paper describes our findings.

2. EXPERIMENTAL SETUP

To investigate this further we needed to find a virtual world which would allow us to observe the movements of other avatars over a long period of time. The virtual world needed to have obvious areas of grass and paths and we needed to be able to identify where these paths were. We used Second Life as the experimental environment for this investigation. This was partly to build upon the work of Yee et al. (2007), partly because Second Life offers a relatively mature, rich and developing environment with a range of users interacting within it, and partly because it offers programmatic access to some of the data within the environment.

Figure 2: *Second Life screenshot. Stage area on the grass in virtual Hyde Park. Note the overhead map in the top right corner. The avatar in this case is a cat.*

We elected to look at the Hyde Park region of Second Life for a number of reasons:

1. We could easily observe the movements of all avatars in a region;
2. An overhead map of the environment was available, showing all the paths;
3. The region was generally flat, giving us a good idea of 'ground level' throughout;
4. All avatars have a 'born on' date. This is the date the avatar was created;
5. Hyde Park is one of the 'starting regions' where new avatars are directed. This leads to a high level of traffic to observe for both new avatars and old.

For those unfamiliar with Second Life, an image is shown in Figure 2.

Avatars are usually humanoid, and there are solid, impenetrable objects within the environments that form buildings and other structures. Much of the rest of the environment is a texture map; in particular, whilst grass is green and paths are brown or grey, there is no other difference between them. It is just as easy for an avatar to move in the grassy areas as it is to move in the paths areas.

We observed the avatars over a 30 hour period from 24th February 2010, and repeated it on 31st May 2012 for a 60 hour period. We did it twice simply to mitigate against any unusual events in either Second Life or the real world that may have affected the results. Both times we used the same environment, though it has changed over time. The Second Life server restarted and went offline on a few occasions in both time periods. We would then restart the observation when the server became available again. We connected to Second Life using the library LibOpenMetaverse

(http://lib.openmetaverse.org/). This provided us with all the information usually given to the standard Second Life client and more if requested. We were able to request an overhead map of the environment, the location and information about all avatars in the connected region and other information such as the location and orientation of all objects in the environment. The library and agent gathering the information were written using C#.

Movements were observed using the information provided by the server. Every 0.5 seconds the server was polled for a list of all the avatars in the area, their current location and their date of birth. We did not gather the date of birth for the 2010 data, as before it was visualised, we did not realise the patterns emerging. All the information was collated, generating a list of all the locations an avatar had been seen at and the time they were observed. Avatars were identified using their unique ID and their location was only recorded when it was different from the previously recorded location. Avatars which chose to hide their date of birth have not been included in this evaluation. All the information was output to a text file.

An example fragment from the observations file has the following format:

Name, DOB
Time, X, Y, Z
Time, X, Y, Z

so the trail information gathered is:

423ae059-b99d-4039-8d3d-a36c69f97a51, 5/30/2012
03:26:21,154.0,67.0,4.0
03:26:56,154.0,67.0,0.0
457e6485-5362-4697-9cc5-dbc5da9fa48e, 5/4/2011
03:27:43,151.0,125.0,24.0
03:27:47,151.0,125.0,20.0
c90a8979-d1c4-4035-8300-0c102638153a, 12/29/2011
03:28:49,219.0,38.0,24.0
03:28:52,219.0,38.0,20.0
04adf1fd-958a-4062-b7db-61fd6387a4ae, 11/6/2006
03:29:00,240.0,107.0,0.0
03:29:03,239.0,108.0,20.0
03:31:32,239.0,112.0,20.0
03:31:33,239.0,116.0,20.0
03:31:34,239.0,120.0,20.0

From the lists of avatars and their locations, we were able to build up a set of routes which each avatar took through the environment. We observed 1088 avatars over both time periods and observed around 45,000 locations. Each location was given as a set of coordinates (X,Y,Z). The relatively flat nature of the world and the Z coordinate allowed us to filter ground level points (where 20 < z < 25) from flying points (Z >= 25).

Figure 3: *Annotated map of the current Hyde Park region of Second Life*

To identify the paths in the region we used the overhead map provided by the virtual world. This was annotated by hand to show where the paths were. Initially we wanted to identify the paths using the pixel colour but the range of colours used to show the 'dirt track' style paths made it faster and more reliable to hand annotate the map. Figure 3 shows the annotated overhead map.

We analysed this information using a Java program which read in the file line by line and compared each location the avatar was observed at against the list of points we knew to be paths. It then calculated a percentage for their movements either flying or walking, both on and off the paths. We filtered out the routes an avatar took which included some period of flying as we are primarily interested in the movements made at ground level and the comparison between how people walk between places in virtual and real environments.

We were then able to create a set of images using Java, visualising the paths each avatar took on top of the overhead map.

2.1. Path or Grass?

While observing the movements of avatars around a virtual world a trend emerged. Despite the lack of barriers, signs or any cost applied, avatars tended to obey the unspoken social convention; they did not walk on the grass.

This is demonstrated in Figure 4 which shows the route taken by an individual avatar in the space. The dotted yellow marks the trail, and most if it is superimposed on the lighter gray of the paths, and it is possible to see curved routes where a straight line

Figure 4: *A single avatar's movements in the Second Life environment*

Figure 6: *Routes taken by avatars in 2010, with flying removed*

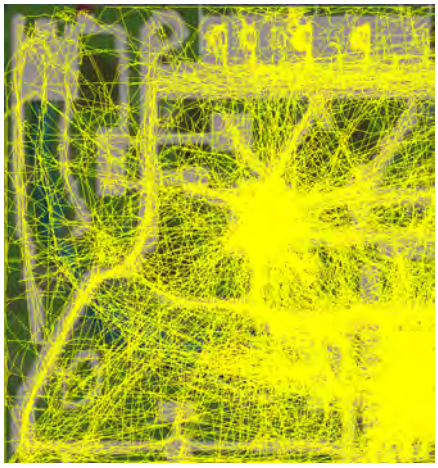

Figure 5: *Routes taken by all avatars in 2012*

Figure 7: *Routes taken by avatars in 2012, with flying removed*

over the grass would clearly have been quicker and there is nothing in the way to prevent it.

If we plot all avatar movements, we get a complex image, as shown in (Figure 5). However, even in this complex image, there are clear routes that appear to follow the paths from place to place. In particular, note that some of these routes are not direct, and short cuts would have been quicker.

This can be simplifyed by removing the trails of avatars that "fly" from place to place. Flying is a recognised method of travelling in Second Life, and is a quick way of moving from place to place: however, we are move interested in how people move when on the ground.

The effect is most noticeable if we plot the total movements of avatars on the overhead map. Images from 2010 (Figure 6) and 2012 (Figure 7) are shown here — note that the blocky nature of the trails in the 2010 images is a plotting artifact from an earlier version of the software we used to render this graphic, and is not significant. Notice that there is a predominance of people arriving in the "hub" — the teleport centre that people arrive in when they request to go to this part of the Second Life world. This is approximately in the centre of each image. A lot of the remaining movement appears to be along paths, with some excursions over grass, and water. Especially in the 2012 image, which contains much more data, the grassy area on the bottom left of the image seems to be an exception to movement over paths. Interestingly, if we actually look at this area in Second Life, it is actually the region shown in Figure 2 above: it's a stage area. It therefore encourages people (avatars) to cluster around it and wander around in that immediate vicinity: walking on the grass seems perfectly reasonable in this case, as it would in real life.

2.2. Digital Age and Changing Norms

We investigated this phenomenon further and looked at whether there was any relationship between the

'age' of the avatar, showing in theory how long someone had been a member of that virtual world, and how often the avatar's movements followed or strayed from the path. We wanted to see whether the more time an individual had spent within virtual worlds, the more likely it was they would break with real world social conventions and walk on the grass.

We also looked at whether there was any correlation between the age of the avatar and how likely they were to use the more unusual mode of transport available, flying. Flying is encouraged by the virtual world, it is a faster mode of transport and there are less barriers to movement. Despite this, the majority of movements are still made at ground level.

We were primarily interested in any correlation between the age of the avatar and the percentage of their observed locations that were off the path. As can be seen from Figure 8 there is (just) a positive correlation between the 'age' of the avatar (in days) and the percentage of their movements that were observed 'off the path'. The older the avatar the more likely it is that they will break with social convention and walk directly between locations rather than take longer, path based, routes. However, there are always exceptions to this rule. Many people who had created an avatar that day (age = 0) were happy to avoid paths where some older avatars primarily kept to the paths. The concentration of avatars along the y-axis of the graph, show that we observed a large number of very young avatars. As this region of second life is one of the starting hubs, where people are directed to after creating their avatar, this is not unexpected.

This highlights a limitation of our current experiment and results. The born on date is not a good measure for how experienced with virtual worlds a user is. An individual who has been using virtual worlds for many years may create a new avatar at any point. They also may have had previous experience in other virtual worlds. The line of best fit does show a positive correlation between the two factors, but the points themselves do not lend much confidence to the result.

There was less of a correlation between avatar age and percentage of their movements flying (see Figure 9). The novelty and speed of flight as a mode of transport leads to it being more popular with avatars no matter the age. Despite flight being a faster and more direct mode of transport less than 20% of the observed movements were in flight. The younger the avatar here, the more likely it is to attempt flying around, but not by much. Practicing and discovering flight is encouraged by the second life tutorials and as the zone is recommended for new users, it is likely that they are still exploring the mechanics of movement in the virtual world, and so would be less likely to engage in the more advanced interaction that is flying.

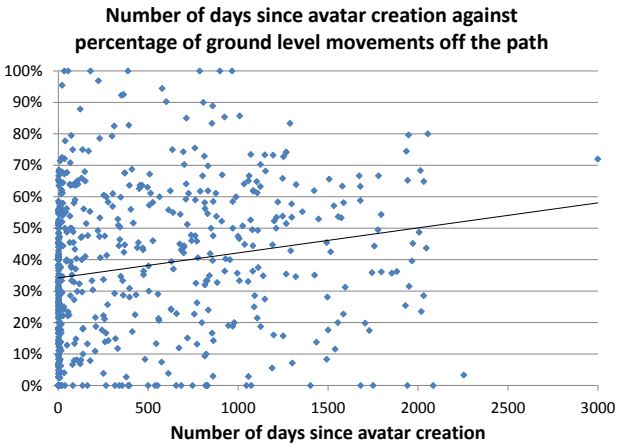

Figure 8: *Results for the age of the avatar vs the percentage of their ground level movements that are not on a path*

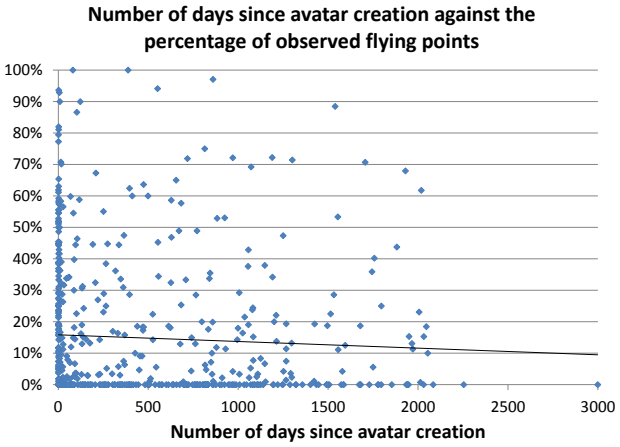

Figure 9: *Results for the age of the avatar vs the percentage of observed flying points*

We undertook a significance test, dividing the data somewhat arbitrarily into 'new' avatars (3 days old or less) and 'older' avatars (7 days or more — 2044 days was the oldest we saw: more than 5 years). For these groups, the young avatars were on the path 58% of the time ($\sigma = 32\%$) compared to the older ones 39% ($\sigma = 33\%$). This is significant (p<0.033), suggesting that younger avatars spend more time on the paths than older ones, but this should be treated with caution since the age in Second Life is suspect anyway, and the division used here is somewhat arbitrary, and other choices may give non-significant results.

3. DISCUSSION AND FUTURE WORK

This work provides strong evidence for a curious observation we made. Avatars, when moving around virtual worlds, tend to stay on the paths, rather than walk directly between places over the virtual grass. It seems clear that a convention from the real world, "Don't walk on the grass" had crossed into virtual worlds, despite there being no need for this. We find this a remarkable result: there is a distinct cost in following paths in virtual worlds — they often meander between locations, require more detailed navigational interactions, and may be congested. There is no virtual mud; there are no wet shoes; there are no park keepers or authority figures who are going to shout at you to keep off the grass — and yet, the real-world norms are so strong that they are instinctively followed by individuals.

We observed the movements of agents over a 60 hour period in a park based region of Second Life. We observed this behaviour quite consistently, and it agreed with data collected two years before: this is a persistent effect. In addition, we find some weak evidence to suggest that the more exposure someone had to virtual worlds, the more likely they would be to break this convention and travel directly from one place to another, since we observed that there was a positive correlation between the 'age' of the avatars and the percentage of their movements that strayed from the path. While this result does agree with our hypothesis, the limitations of the experiment mean that we don't have huge confidence in this nuance in the results, and further more detailed work is needed to test this hypothesis properly.

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